

## **What is claimed is:**

**[Claim 1]** An automotive head restraint assembly for use in an automotive seat assembly having a seatbase defining a seatbase plane and a seatback defining a seatback plane, said automotive head restraint assembly comprising:

a head restraint support member having at least one horizontal travel arm generally perpendicular to the seatback plane and a horizontal base arm; a head restraint inner structure engaging said at least one horizontal travel arm, said head restraint inner structure movable linearly to a plurality of positions along said at least one horizontal travel arm; and an active head restraint element mounted to said head restraint inner structure and said horizontal base arm, said active head restraint element movable between a stowed position and a deployed position, said active head restraint element moving said head restraint inner structure to a head restraint forward position in response to said active head restraint element moving into said deployed position, said active head restraint element deployed towards said deployed position during vehicle impact.

**[Claim 2]** An automotive head restraint assembly as described in claim 1, wherein said active head restraint element is biased towards said deployed position and said active head restraint element further comprises:

a trigger element retaining said active head restraint element in said stowed position, said trigger element releasing said active head restraint element during vehicle impact.

**[Claim 3]** An automotive head restraint assembly as described in claim 2, further comprising:

a motion translation element pivotably including a back translation portion mounted within the seatback, said motion translation element in communication with said trigger element such that said trigger element releases said active head restraint in response to said back translation portion moving into a back intrusion position.

**[Claim 4]** An automotive head restraint assembly as described in claim 1, further comprising:

a motion translation element including a back translation portion mounted within the seatback, said motion translation element in communication with said active head restraint element such that as said back translation portion moves into a back intrusion position said active head restraint element is moved into said deployed position.

**[Claim 5]** An automotive head restraint assembly as described in claim 1, further comprising:

a plurality of uni-directional engagement notches formed on said at least one horizontal travel arm; and

a locking arm mounted to said head restraint inner structure, said locking arm biased to engage said plurality of uni-directional engagement notches, said locking arm movable between a locking arm engagement position and a locking arm disengagement position, said locking arm disengagement position allowing said head restraint inner structure to be movable linearly to a plurality of positions along said at least one horizontal travel arm, said uni-directional engagement notches allowing said active head restraint element to move said head restraint inner structure to said head restraint forward position while said locking arm is in said locking arm engagement position.

**[Claim 6]** An automotive head restraint assembly as described in claim 1, further comprising:

a locking arm mounted in rigid positional communication with said head restraint support member; and

a cam assembly positioned between and in communication with said locking arm and said head restraint inner structure, said cam assembly forcing said head restraint inner structure forward in response to rotation of said locking arm, said head restraint inner structure biased rearward against said cam assembly.

**[Claim 7]** An automotive head restraint assembly as described in claim 1, wherein said active head restraint element comprises a hinge element, said hinge element movable between a hinge folded position and a hinge unfolded position, said hinge folded position corresponding to said stowed position.

**[Claim 8]** An automotive head restraint assembly as described in claim 7, further comprising:

a hinge storage compartment formed in said head restraint inner structure, said active head restraint element stored in said hinge storage compartment when in a head restraint rearward position.

**[Claim 9]** An automotive head restraint assembly as described in claim 6, wherein as said active head restraint element moves into said deployed position said cam assembly is moved out of communication with said head restraint inner structure such that said cam assembly does not interfere with said active head restraint element.

**[Claim 10]** An automotive seat assembly comprising:

a seatbase defining a seatbase plane;  
a seatback defining a seatback plane;

a head restraint support member configured to extend vertically from the seatback, said head restraint support member having a vertical extension portion extending generally parallel to the seatback plane, at least one horizontal travel arm generally perpendicular to the seatback plane, and a horizontal base arm;  
a head restraint inner structure engaging said at least one horizontal travel arm, said head restraint inner structure movable linearly to a plurality of positions along said at least one horizontal travel arm; and  
an active head restraint element mounted to said head restraint inner structure and said horizontal base arm, said active head restraint element movable between a stowed position and a deployed position, said active head restraint element moving said head restraint inner structure to a head restraint forward position in response to said active head restraint element moving into said deployed position, said active head restraint restraint element biased towards said deployed position; and  
a trigger element retaining said active head restraint element in said stowed position, said trigger element releasing said active head restraint element during vehicle impact.

**[Claim 11]** An automotive seat assembly as described in claim 10, wherein said head restraint support member comprises a tubular support member, said at least one horizontal travel arm comprising a pair of horizontal travel arms, said horizontal base arm positioned between said pair of horizontal travel arms.

**[Claim 12]** An automotive seat assembly as described in claim 10, further comprising:

a plurality of engagement notches formed on said at least one horizontal travel arm; and  
an locking arm mounted to said head restraint inner structure, said locking arm biased to engage said plurality of engagement notches, said locking arm movable between a locking arm engagement position and a locking arm disengagement position, said locking arm disengagement position allowing said head restraint inner structure to be movable linearly to a plurality of positions along said at least one horizontal travel arm.

**[Claim 13]** An automotive seat assembly as described in claim 12, wherein said plurality of engagement notches comprises:

a plurality of uni-directional engagement notches, said uni-directional engagement notches allowing said head restraint inner structure to be movable relative to said at least one horizontal travel arm in only a forward direction when said locking arm is in said locking arm engagement position.

**[Claim 14]** An automotive head restraint assembly as described in claim 10, further comprising:

a travel channel formed through said head restraint inner structure, said at least one horizontal travel arm positioned within said travel channel, said travel channel engaging said at least one horizontal travel arm such that said head restraint inner structure is constrained into linear travel along said at least one horizontal travel arm.

**[Claim 15]** An automotive seat assembly as described in claim 10, further comprising:

a motion translation element including a back translation portion mounted within the seatback, said motion translation element in communication with said active head restraint element such that as said back translation portion moves into a back intrusion position said active head restraint element is moved into said deployed position.

**[Claim 16]** An automotive seat assembly as described in claim 10, wherein said active head restraint element comprises a hinge element, said hinge element movable between a hinge folded position and a hinge unfolded position, said hinge folded position corresponding to said stowed position.

**[Claim 17]** A method of providing linear fore/aft motion to an automotive head restraint assembly comprising:

rotating a motion translation element positioned within a seatback from a back engagement stable position to a back intrusion position;  
activating an active head restraint element in response to said motion translation element moving into said back intrusion position, said active head restraint element mounted to a head restraint inner structure and a horizontal base arm of a head restraint support member;  
moving said active head restraint element into a deployed position in response to activating said active head restraint element, said active head restraint element moving said head restraint inner structure linearly forward along a horizontal travel arm formed as a portion of said head restraint support member, said head restraint inner structure moving to a head restraint forward position in response to said active head restraint moving into said deployed position, said head restraint inner structure including a travel channel engaging said horizontal travel arm such that said head restraint inner structure is movable linearly to a plurality of positions along said at least one horizontal travel arm.

**[Claim 18]** A method of providing linear fore/aft motion to an automotive head restraint assembly as described in claim 17, further comprising:

biasing said active head restraint towards said deployed position;  
locking said active head restraint in a stowed position; and  
releasing said active head restraint during activation such that said active head restraint moves into said deployed position.

**[Claim 19]** A method of providing linear fore/aft motion to an automotive head restraint assembly as described in claim 17, further comprising:  
biasing said active head restraint towards said deployed position;  
locking said head restraint inner structure in one of said plurality of positions utilizing a locking arm mounted to said head restraint inner structure, said locking arm engaging one of a plurality of engagement notches formed on said horizontal travel arm; and  
releasing said locking arm in order to activate said active head restraint element.

**[Claim 20]** A method of providing linear fore/aft motion to an automotive head restraint assembly as described in claim 17, further comprising:

locking said head restraint inner structure from rearward motion in one of said plurality of positions utilizing a locking arm mounted to said head restraint inner structure, said locking arm engaging one of a plurality of engagement notches formed on said horizontal travel arm, said plurality of engagement notches comprising unidirectional notches allowing said head restraint inner structure to be moved forward into said head restraint forward position while said locking arm is in an engagement position.